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ABSTRACT

The present experiment investigated: (1) the effect of pictorial elaboration on low socioeconomic-status Mexican-American children's long term memory for noun pairs; (2) the effects of labeling mode on estimates of paired-associate acquisition and retention; and (3) the interrelationships between paired-associate task performance and school achievement. The basic design was a 2x2 crossed factorial with pictorial presentation (standard vs. elaborated) and labeling mode (English vs. Spanish). In the acquisition phase of the experiment, 60 second grade children learned a twenty-pair list of common noun referents labeled in English or Spanish. The children learned the list to a leniently scored criterion of 16/20 correct by the study-test paired-associate method. After seven days, retention was assessed by cued-recall and multichoice tests. The results indicated that while elaborated pictorial presentation enhanced the rate of original learning, it neither helped nor hindered the children's long term memory for the pairs. Estimates of original learning and retention did not vary as a function of labeling mode. The rate of paired-associate learning was significantly related only to reading achievement within the elaborated presentation condition. There were no reliable correlations between the indices of paired-associate retention and school achievement. (Author/ AM)

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PICTORIAL ELABORATION EFFECTS ON MEXICAN-AMERICAN CHILDREN'S LONG TERM MEMORY FOR NOUN PAIRS

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ABSTRACT

The present experiment investigated the effect of pictorial elaboration on low socioeconomic-status Mexican-American children's long term memory for noun pairs. The basic design was a 2x2 crossed factorial with pictorial presentation (standard vs. elaborated) and labeling mode (English vs. Spanish). In the acquisition phase of the experiment, sixty second grade children learned a twenty pair list of common noun referents. The children learned the list to a leniently scored criterion of 16/20 correct by the study-test paired-associate method. After seven days, retention was assessed by cued-recall and multichoice tests. The results indicated that while elaborated pictorial presentation enhanced the rate of original learning, it neither helped nor hindered the children's long term memory for the pairs. Estimates of original learning and retention did not vary as a function of labeling mode. The rate of paired-associate learning was significantly related only to reading achievement within the elaborated presentation condition. There were no reliable correlations between the indices of paired-associate retention and school achievement.

PICTORIAL ELABORATION EFFECTS ON MEXICAN-AMERICAN CHILDREN'S LONG TERM MEMORY FOR NOUN PAIRS

Elaboration is an effective coding strategy in the paired-associate learning of noun pairs (cf. Pressley, 1977; Reese, 1977; Rohwer, 1973). This strategy consists of creating a meaningful relationship between the otherwise disparate pair members. Young children do not spontaneously engage in elaborative coding (e.g., Rohwer & Bean, 1973), however they can be prompted to do so. Two prompts that are effective with young children are imposed pictorial and verbal elaboration. In pictorial elaboration, noun referent pairs are depicted in a spatial interaction (e.g., a picture of a pencil inserted through a cake). Pictorial elaboration is usually compared to the standard presentation of the referents spatially separated (i.e., side by side). Verbal elaboration consists of presenting the noun pairs connected by a preposition or verb (e.g., "the pencil through the cake"), and is generally compared to the standard presentation of the nouns alone or connected by a conjunction. The typical outcome of such comparisons is that elaborated presentation facilitates children's paired-associate learning relative to standard presentation (Davidson & Adams, 1970; Kee, 1976; Kee & Rohwer, 1973, 1974; Rohwer, Kee & Guy, 1975).

Research has focused primarily on the effects of verbal and pictorial elaboration on the initial acquisition of noun pairs. The facilitation associated with both modes of elaboration has been demonstrated under a wide variety of task and subject conditions (cf. Rohwer, 1973). Research concerning the potential long term

benefits of verbal and pictorial elaboration has been minimal. Moreover, the findings from many of the studies which have addressed this issue have been inconclusive. The degree of original learning was not adequately controlled between the experimental conditions prior to the retention interv thereby precluding an uncontaminated estimate of retention effects (e.g., Forbes & Reese, 1974; Kerst & Levin, 1973; Reese, 1972; 1975; Reese & Parkington, 1973; Rohwer, Ammon, Suzuki & Levin, 1971). One exception is a study by Kee and Sherwin (1977) which investigated the effects of verbal and pictorial elaboration on second grade, Anglo-American children's long term memory. In order to equate the degree of original learning, children learned the paired-associate list to a criterion of 80% correct by a cued-recall test procedure. Retention was assessed after a seven day interval by three consecutive cued-recall tests. The results indicated that verbal and pictorial elaboration facilitated acquisition, but did not affect the children's long term memory for the noun pairs.

A follow-up investigation was also reported by Kee and Sherwin (1977). This experiment, which replicated the design and procedures of the first experiment, was conducted with a population of low socioeconomic-status (SES) Mexican-American children. In contrast to the findings with middle SES Anglo-American children (i.e., Experiment 1), the results of the follow-up study indicated that pictorial and verbal elaboration enhanced long term memory for the pairs as well as their acquisition. A clear interpretation of this finding was mitigated, however, by the discovery of marginally significant ($p < .10$) differences in the degree of original learning which favored the elaboration conditions. These minor differences were detected under a

lenient scoring of criterion trial performance which accepted Spanish equivalents as correct responses in addition to the provided English labels. As a result, it is not clear whether the observed retention benefits reflect differential forgetting in this population or merely differences in the number of pairs originally learned (cf. Underwood, 1964).

The present investigation was conducted to provide a more decisive assessment of elaboration effects on the long term memory of Mexican-American children. The results from the preliminary study reported by Kee and Sherwin with Mexican-American children suggests that language ability may influence estimates of both acquisition and retention. Thus, in the present study the following precautions were taken. First, a lenient scoring procedure was used in acquisition to establish criterion trial performance. According to this procedure, synonyms and Spanish/English equivalents were accepted in addition to the provided labels. Second, a comparison was made between labeling modes (English vs. Spanish). The English labeling condition replicates the presentation conditions of Kee and Sherwin's experiment. A comparison between the two labeling conditions will indicate whether estimates of either acquisition or retention vary as a function of language mode.

In the current experiment, the principal comparison of interest was between elaborated pictorial presentation and standard pictorial presentation. This comparison replicates two of the four conditions in the Kee and Sherwin study. The selection of the pictorial mode of elaboration for use in this investigation was based on three considerations. First, a limitation in the number of available subjects precluded an

assessment of both pictorial and verbal elaboration effects. Second, the results of the two experiments reported by Kee and Sherwin indicated that the retention effects are identical for the two modes of presentation. Finally, the pictorial mode minimized the role of language and thereby provided a more robust manipulation of elaboration in a population whose members may vary substantially in language ability. Similar to the procedure used by Kee and Sherwin, retention was assessed after a seven day interval by three consecutive cued-recall tests. In addition, a fourth multichoice test trial was included in the current experiment. The administration of a pictorial multichoice test may provide a more sensitive index of the number of pairs actually retained under the different conditions because it removes the response availability requirement which is inherent in the cued verbal recall procedure.

An opportunity was also provided in this study for a preliminary assessment of the relationship between paired-associate task performance (both acquisition and retention) and school achievement indices. This correlational analysis will extend the findings reported for Anglo-American and Black populations (e.g., Rohwer, Ammon, Suzuki & Levin, 1971; Starkman, Butkovich & Murray, 1977; Stevenson, Hall, Klein & Miller, 1968).

In summary, the present study addresses three specific problems concerning Mexican-American children: (1) the influence of pictorial elaboration on long term memory, (2) the effects of labeling mode on estimates of paired-associate acquisition and retention, and (3) the interrelationships between paired-associate task performance and school achievement.

METHOD

Design

Subjects participated in two experimental sessions: (1) acquisition, and (2) retention. The basic design of the experiment consisted of a 2x2 crossed factorial w pictorial presentation (standard vs. elaborated) and labeling mode (English vs. Spanish). At retention the basic design was augmented to include the within subjects factor of trials (three cued-recall trials and a fourth trial multichoice test).

Materials and Procedures

Two distinct lists of twenty noun pairs were used. One list was identical to that used by Kee and Sherwin (1977). The other was selected from a different set of noun pairs which has been used in previous investigations concerning elaboration effects (Kee, 1976). Nouns for both lists were originally selected from first and second grade reading primers and were highly familiar to second grade children (e.g., cow, tie, glasses, table). Line drawings of the referents were prepared and photographed onto 35-mm slide transparencies. In the standard pictorial presentation condition, the referents were depicted side by side. In the elaborated pictorial presentation condition they were depicted in a spatial interaction (e.g., a picture of a chain inside a bowl). In order to control for response availability, verbal labels connected by a conjunction were provided for the pictorial pairs presented on the study trials (e.g., "the chain and the bowl"). Half the children in each presentation condition heard the labels in English (English labeling condition) while half heard the labels in Spanish (Spanish labeling condition). A total of ten random orders were constructed

for each list. Six of these orders were arranged into a sequence of three study-test cycles for use during the acquisition phase of the experiment. The final four orders of the list were used for the test trials in the retention phase of the experiment.

Subjects were tested individually in a room at the participating school. They were seated at a small table on which a side screen projection unit was placed. The experimenter, who was conversant in Spanish, was the same Anglo-American female who tested subjects in Kee and Sherwin's first experiment. A study-test paired-associate procedure was used during acquisition. The subject was informed that twenty pairs of nouns would be presented and that (s)he should learn them in such a way as to be able to produce the name of one member of the pair when presented with the other. Two practice pairs were presented in a study-test format to ensure that the subject understood the instructions. Pictorial presentation was made by a 35-mm Kodak slide projector synchronized with a Wollensak #2551 cassette recorder which presented the appropriate (English or Spanish) verbal labels from a prerecorded tape. The rate of presentation on study and test trials was four seconds per pair. On the test trials, stimulus cue presentation was both aural and pictorial. Subjects were required to learn the pairs to a criterion of 16/20 correct. If necessary, the previously described set of three study-test trials was recycled in sequence until the subject achieved criterion performance. In order to sensitively index original learning, a lenient scoring procedure was used throughout acquisition. According to this procedure, synonyms and Spanish/English equivalents were

accepted as correct responses in addition to the provided English/ Spanish labels. Subjects were required to return after seven days for the retention test. This test consisted of three consecutive cued-recall test trials followed by a single multichoice test trial. Stimulus cue presentation was both aural and pictorial. The test trial rate was subject paced, however the stimulus cue was advanced if the subject failed to provide a response within ten seconds. On the first three (cued-recall) test trials the subject was asked to verbally recall the associate in English or Spanish, whichever (s)he preferred. On the fourth (multichoice) test trial the subject was provided with a pictorial response booklet which consisted of twenty pages, one per stimulus cue. The booklet was constructed so that: (1) each page contained ten different response pictures from within the list, (2) each response picture occurred ten times throughout the booklet, (3) no response picture appeared twice on a page, (4) the correct response appeared on the appropriate page; and (5) the correct response appeared an equal number of times in each of the ten possible positions on the page. Subjects were asked to designate, by a pointing response, the correct associate for each stimulus cue presented on the multichoice test.

School achievement indices consisted of the reading and mathematics subtests of the Comprehensive Test of Basic Skills (CTBS), Form S, Level C. These tests were routinely administered by the school which the subjects attended. The school's administration of the CTBS subtests coincided with the conclusion of paired-associate testing in this experiment.

Subjects

The subjects were sixty second grade children. Their modal age was seven years. The children attended school and resided in a low SES Mexican-American community in Los Angeles, California. Census tract data (1970) revealed that the median income of this community was $5,467 and the median educational level was 7.9 years. All sixty children had Spanish surnames. Forty four were bilingual, eight spoke only Spanish and eight spoke only English. Language competency was determined by: (1) teacher's evaluation, (2) subject self report, and (3) the subject's ability or inability to converse with the experimenter in English and Spanish. Equal numbers of children from the above classifications were represented in each of the four experimental conditions previously described. Due to a limitation in the number of available children, it was not possible to achieve an exact balancing of subjects on the two paired-associate lists used in each condition. However, in three of the conditions the difference was one subject, while in the remaining condition the difference was three subjects.

RESULTS

The results are reported in three parts: (1) acquisition effects, (2) retention effects, and (3) school achievement correlates. The Type 1 error rate for all tests was set at .05, except where otherwise indicated. Two complete analyses of the data were conducted, one for the subsample of forty-four bilingual children and the other for the complete sample which included an additional sixteen children who spoke only Spanish or English. The patterns of performance at acquisition and retention were identical for both samples as a function of presentation

condition and labeling mode. Therefore, only the results for the complete sample will be presented.

The analysis also indicated that the factor of labeling mode and the interaction of labeling mode with presentation condition were not associated with any effects in either phase of the experiment. That is, no significant differences were observed on the primary dependent variables of trials to criterion (all $\underline{F}$s < 1), number correct on the criterion trial (all $\underline{F}$s ≤ 1), cued-recall loss scores (all $\underline{F}$s < 1 with one exception where $\underline{F}(1,56) = 3.86$, $\underline{p} > .05$), or multichoice loss scores (all $\underline{F}$s < 1). Thus it appears that estimates of the rate of learning, the terminal degree of original learning and retention did not vary reliably as a function of the labeling mode. Accordingly, no further distinction will be made as to labeling mode in the discussion of the results, although the means associated with this factor will be presented for inspection along with the means for the pictorial presentation factor.

Acquisition Effects

The rate of learning was indexed by the number of trials required to reach the 80% performance criterion. Table 1 presents the means for

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Insert Table 1 about here

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the experimental conditions. Analysis of variance revealed a significant pictorial presentation effect, $\underline{F}$ (1,56) = 35.34, indicating that the children in the elaboration condition required fewer trials to reach criterion than children in the standard condition. This finding is consistent with the literature in that elaboration facilitated the

acquisition of the noun pairs (cf. Rohwer, 1973).

The degree of learning attained by the conclusion of the acquisition phase was indexed by the number of correct responses given on the criterion trial. Table 2 presents the means for the experimental

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Insert Table 2 about here

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conditions. Analysis of variance failed to detect a reliable difference between the standard and elaborated presentation conditions, F (2,56) = 2.86. $p > .10$, indicating that the degree of original learning was successfully equated prior to the start of the retention interval.

Retention Effects

Loss scores were computed for each subject based on the number of items correct on the criterion trial minus the number of items correct on each retention test trial. The means for the experimental conditions, collapsed across the three cued-recall test trials, are presented in Table 3. An analysis of variance with repeated measures

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Insert Table 3 about here

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was conducted on the loss scores for the three cued-recall test trials. No significant effect was associated with the factor of pictorial presentation ($F < 1$). This outcome is consistent with the previous findings reported by Kee and Sherwin (1977) for Anglo-American children, indicating that elaboration does not have an effect on retention when the degree of original learning is controlled. The only significant source of variance in this analysis was a main effect of trials, F (2,112) = 28.86, indicating that the number of items lost declined over the three cued-recall test trials. The mean number of items lost was 5.41 items

(Trial 1), 4.67 items (Trial 2), and 4 [illegible] items (Trial 3). This decline in loss scores over the three test trials suggests that the context of original learning may have been reinstated by the repeated testing, thereby increasing the probability of correct response selection and retrieval.

Both extralist and intralist intrusions were tabulated for the three cued-recall test trials The rate of extralist intrusions was very low ($\underline{M}$ = .30). Analysis of variance with repeated measures failed to reveal any significant source of variance. The rate of within-list intrusions was 1.92 items. Analysis of variance with repeated measures revealed that the only reliable effect was a labeling mode by trials interaction, $\underline{F}$ (2,112) = 3.46. The form of the interaction indicated that the number of within-list intrusions declined over trials with English labeling but increased over trials with Spanish labeling. This finding, however, has no obvious implication for the elaboration effects observed in this study since the actual number of pairs lost did not vary reliably as a function of labeling mode. Thus, this interaction will not be treated in greater detail.

As noted earlier, a multichoice test was administered after the three cued-recall test trials. The results indicated that the mean number of items lost declined dramatically between the third cued-recall test ($\underline{M}$ = 4.44) and the multichoice test ($\underline{M}$ = 2.47). This finding is consistent with the notion that a recognition test procedure offers a more sensitive index of the number of associates actually retained by removing the response availability requirement of the cued verbal recall procedure. Table 4 presents the mean loss scores for the multichoice test

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Insert Table 4 about here

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as a function of the experimental conditions. An analysis of variance performed on the loss scores for this test trial also failed to reveal a significant effect for pictorial presentation condition ($F < 1$). Thus, the results of both the pictorial multichoice and the cued verbal recall tests indicate that elaboration does not affect the long term memory of low SES Mexican-American children when the degree of original learning is appropriately controlled.

School Achievement Correlates

A correlational analysis was conducted to assess the relationship between three indices of paired-associate performance (trials to criterion, cued-recall loss scores and multichoice loss scores) and two indices of school achievement (reading and math subtests of the CTBS). Scores on the school achievement indices were available for 27/30 children in the standard presentation condition and 25/30 children in the elaborated presentation condition. Scores on the reading index of achievement were significantly related to scores on the math index of achievement within the standard presentation condition ($r = .76$) and within the elaborated presentation condition ($r = .45$). Table 5 reports the intercorrelations

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Insert Table 5 about here

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between the paired-associate indices and the achievement indices within each pictorial presentation condition. As an inspection of that table reveals, the only reliable relationship was between the reading index of achievement and the trials-to-criterion index of paired-associate learning within the elaborated presentation condition ($r = -.36$). The negative sign of this correlation indicates that higher reading achievement

test scores were associated with fewer learning trials (i.e., with more rapid acquisition of the pairs).

DISCUSSION

Elaboration Effects

Kee and Sherwin (1977) reported that both pictorial and verbal elaboration may benefit the long term memory of Mexican-American children. However, differences in the degree of original learning were observed in that study. Thus, it was not clear whether the observed retention effects reflected differential forgetting in this population or differential degrees of original learning. The manipulations and procedures included in the present experiment were designed, therefore, to provide a more definitive assessment of elaboration effects on Mexican-American children's long term memory for noun pairs. The results clearly indicate that while pictorial elaboration facilitates the acquisition of noun pairs, it neither helps nor hinders their long term retention. This finding was general across labeling mode (English vs. Spanish) and the different types of retention tests (cued verbal recall and the more sensitive pictorial multichoice test).

The present findings are consistent with the results reported by Kee and Sherwin for a population of middle SES Anglo-American children. Also, the absence of a direct retention effect for elaboration when the degree of original learning was controlled is consistent with the lack of retention effects reported for other powerful learning variables. For example, such variables as individual differences in learning ability (Shuell & Keppel, 1970), meaningfulness (Underwood & Richardson, 1956), imagery instruction (Hasher, Riebman & Wren, 1976), and printed verbal

elaboration (Olton, 1969) have been shown to influence the rate of learning but not retention when the degree of initial learning is equated.

School Achievement Correlates

The present investigation provided an opportunity to conduct a preliminary assessment of the relationships between paired-associate learning rate, retention and measures of school achievement in a population of low SES Mexican-American children. There was a significant correlation between trials-to-criterion and reading achievement in the elaboration condition, but not in the standard condition. These findings are consistent with the notion that when conceptual processes are elicited in the paired-associate task, performance on this task can be relevant to school learning (Labouvie-Vief, Levin & Urberg, 1975; Rohwer, 1971). The results failed to detect any relationship between paired-associate retention and school achievement. This latter outcome supplements the findings of previous studies which have focused primarily on the relationship between paired-associate acquisition and indices of school achievement and intelligence in Anglo-American and Black children (Lambert, 1970; Rohwer, Ammon, Suzuki & Levin, 1971; Stevenson, Hall, Klein & Miller, 1968).

The reported correlations may have been attenuated, however, by the restricted range of scores on the trials-to-criterion index of learning and the loss score indices of retention. The range of scores on the achievement indices was also restricted in that approximately 85% of the children in this sample performed below the national 50th percentile on the California Test of Basic Skills. Future research might be directed at obtaining more decisive estimates of the relationship between paired-associate performance and achievement in Mexican-American children.

In summary, the present study indicates that pictorial elaboration does not have a direct effect on Mexican-American children's long term retention of noun pairs. The absence of a direct retention effect, however, does not lessen the potential utility of elaboration in an educational setting. That is, in the current experiment it was found that the same level of retention was maintained with half as many study-test cycles under elaborated presentation as under standard presentation of the paired-associate list. This "cost effectiveness" analysis suggests that elaborated presentation is to be preferred over standard presentation regardless of whether one is interested in facilitating learning or sustaining a given level of long term memory.

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Table 1

Mean Number of Trials to Criterion as a function of Pictorial Presentation and Labeling Mode

	Pictorial Presentation		
Labeling Mode	Standard	Elaborated	M
English	6.40	3.20	4.80
Spanish	6.07	2.47	4.27
M	6.23	2.83	

Note: MS_e (56) = 4.90

Table 2

Mean Number Correct on the Criterion Trial as a function of Pictorial Presentation and Labeling Mode

	Pictorial Presentation		
Labeling Mode	Standard	Elaborated	M
English	16.87	16.93	16.90
Spanish	16.53	17.20	16.87
M	16.70	17.07	

Note: MS_e (56) = 1.09

Table 5

Cued-recall tests: Mean loss scores as a function of Pictorial Presentation and Labeling Mode

	Pictorial Presentation		
Labeling Mode	Standard	Elaborated	M
English	4.02	4.18	4.10
Spanish	5.38	5.78	5.58
M	4.70	4.98	

Note: MS_e (56) = 25.45

Table 4

Multichoice test: Mean loss scores as a function of Pictorial Presentation and Labeling Mode

Labeling Mode	Pictorial Presentation		
	Standard	Elaborated	M
English	1.73	.40	1.07
Spanish	1.80	1.93	1.87
M	1.77	1.17	

Note: MS_e (56) = 8.31

Table 5

Intercorrelations between indices of paired-associate performance and school achievement

Achievement Index	Pictorial Presentation: Standard — Trials to Criterion	Standard — Cued-Recall[a] Loss Scores	Standard — Multichoice Loss Scores	Elaborated — Trials to[b] Criterion	Elaborated — Cued-Recall[a] Loss Scores	Elaborated — Multichoice Loss Scores
Reading	-.27	-.01	-.13	-.36*	.18	.28
Math	-.25	-.06	-.08	-.08	.22	.23

* $p < .05$, one-tailed test

[a] The correlations were equivalent for each cued-recall test trial. Consequently, the reported correlations were based on the mean loss scores for the three cued-recall test trials.

[b] The negative correlation indicates that higher achievement scores were associated with fewer trials (i.e., with more rapid learning)